

Three new Afrotropical dung beetles (Coleoptera: Scarabaeinae) in the genera, *Kheper* Janssens, *Gymnopleurus* Illiger and *Onitis* Fabricius, with notes on related species.

by

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Kheper zurstrasseni **sp. nov.** from South Africa, *Gymnopleurus particolor* **sp. nov.** from west Africa and *Onitis autumnalis* **sp. nov.** from south east Africa, are described and their relationships discussed. *K. clericus* (Boheman) is redescribed and its geographical distribution is illustrated on a map together with those of the closely-related *K. zurstrasseni* and *K. bonellii* (MacLeay). A key is provided to separate *O. autumnalis* from six closely-related species and the geographical distribution of all seven species is depicted by maps.

In 1970, the Commonwealth Scientific and Industrial Research Organization (CSIRO) established the Dung Beetle Research Unit (DBRU) in Pretoria, South Africa, to study and select species of dung-burying beetles suitable for introduction into Australia (Bornemissza 1976). During the 16 years of the DBRU's existence a large reference collection of these beetles (Scarabaeinae) has been amassed. This now numbers approximately 50000 specimens belonging to about 850 species. These were collected mainly in Nigeria, Kenya, Tanzania and Africa south of the River Zambezi.

The present publication describes species from this collection and those of the National Collection of Insects, Pretoria, the South African Museum, Cape Town, the British Museum (Natural History), London, and the Muséum National d'Histoire Naturelle, Paris. In particular, it includes the redescription of *Kheper clericus* (Boheman), formerly known only by the female holotype; the description of a new *Kheper* Janssens which has been confused with *K. clericus*; the description of a new *Onitis* Fabricius, previously confused with *O. caffer* Boheman; and the description of a new *Gymnopleurus* Illiger.

Genus *KHEPER* Janssens, 1940

The Afrotropical and Oriental genus, *Kheper*, was described by Janssens (1940a) in a partial revision of the tribe, Scarabaeini. Besides diagnostic features of the genus, a key to all the known species was included in this publication. There has been no subsequent revision of these taxa.

Kheper clericus (Boheman), Figs 1-3, 12

Ateuchus clericus Boheman, 1857. *Insecta caffrariae* 2: 167.

Kheper clericus (Boheman): Janssens, 1940a.

MALE. Black with a muted, non-metallic sheen; all hairs and setae deep brown or black, tips of setae sometimes tan. Length, 17-29 mm; mean, 23 mm ($n = 17$); maximum width, 9-16 mm; mean, 13 mm.

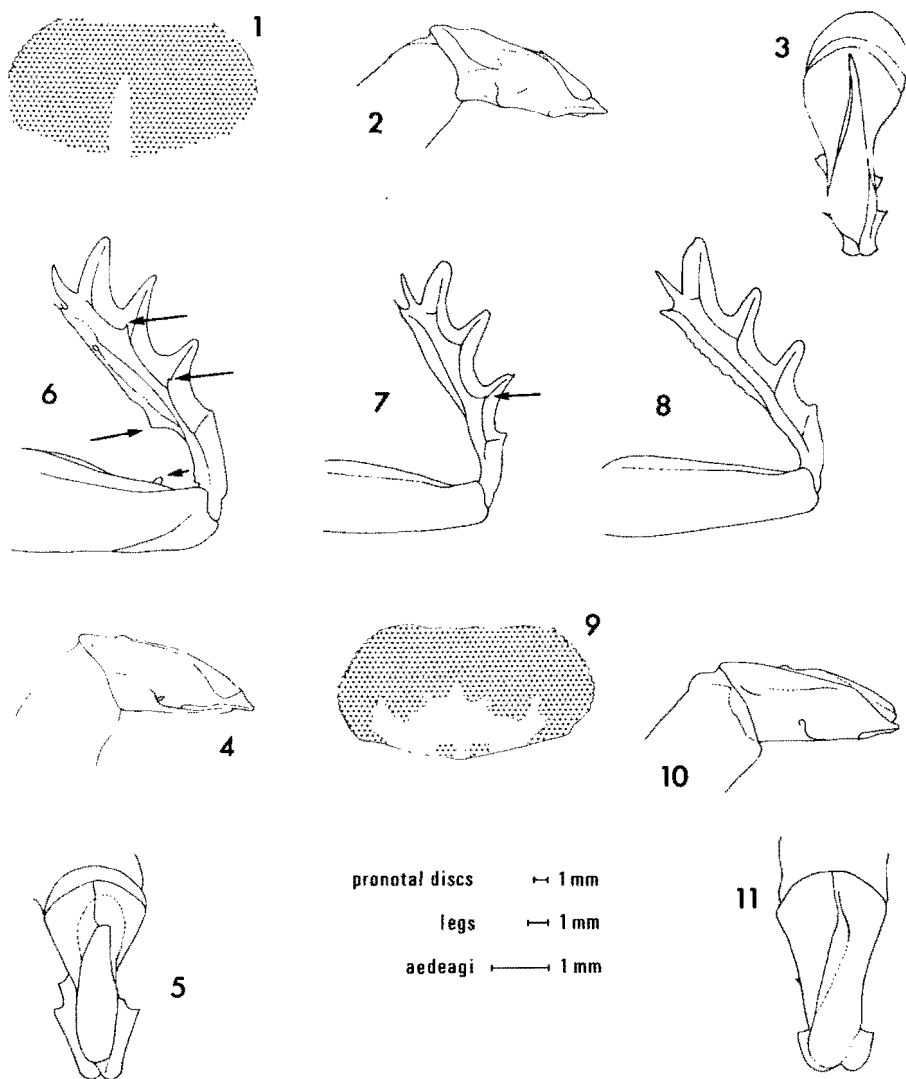
Head. Anterior margins of clypeus and genae sexdentate; tips of clypeal teeth smooth ($\times 10$); clypeus and genae with raised, acute ridging enclosing elongate and ovoid, scalloped depressions; frons very slightly raised, rounded, rugose and micropunctate; vertex coarsely pitted, somewhat rugose laterally. Frontal suture slightly raised laterally, effaced medially; clypeo-genal sutures incised and smooth.

Thorax. Dense, anterior and lateral macrogranulation of pronotal disc merging into lunate and umbilicate macropunctuation medially; macropunctuation usually becoming fine, sparse and roughly isodiametric posteriorly on disc, but sometimes remaining coarse especially in smaller specimens; small, ill-defined, posterior, mid-longitudinal area of disc (approximately 5%) lacking macropunctuation (Fig. 1). Entire disc with very fine, contiguous microgranulation ($\times 20$); microgranulation becoming gradually overlaid by micropunctuation posteriorly. Metasternum smooth medially, moderately punctate and pilose laterally; metasternal protuberance rounded, smooth ventrally with moderately dense asperate granules and pilosity laterally. Elytra fairly smooth ($\times 10$), but densely microgranular with incipient microrugosity not elevated ($\times 20$); striae fairly distinct ($\times 10$); interstriae with very sparse, fine punctation ($\times 20$) loosely arranged in 2 rows per interstria. Dorsal surface of fore tibia with a small denticle at the base of tibial tooth 2. Internal superior ridge of hind tibia with a row of long setae; median setae longer and more densely packed.

Abdomen. Sternites predominantly smooth with a little coarse punctation laterally on sternites 1, 5 and 6; sternites 2, 3 and 4 with a row of short but distinct ($\times 10$) densely packed setae antero-laterally. Pygidium moderately punctate; aedeagus as in Figs 2, 3.

FEMALE. Length, 18-25 mm, mean, 23 mm ($n = 14$). Only slightly different from male; setae on internal superior ridge of hind tibia of uniform density; setae antero-laterally on sternites 2, 3 and 4 sparse and indistinct ($\times 10$).

MATERIAL EXAMINED. Information in square brackets is not cited on the locality labels of the specimens. Holotype ♀: SOUTH AFRICA, Natal, Caffraria, J. Wahlb[erg]. Other material: 1 ♂ and 2 ♀♀, Hluhluwe G. R. [= Game Reserve] [28°-28° 09' S, 32°-32° 09' E], 15.xi.74, G. Tribe; 1 ♂, Umfolozi G. R. [28° 14'-26' S, 31° 43'-58' E], 29.x.73, Tribe and Temby; 1 ♀, Mkuzi G. R. [27° 34'-46' S, 32° 04'-22' E], 15.xi.74, G. Tribe. 1 ♂ and 1 ♀, Mkuzi G. R., (Tinley's Dam/ Nhlonhlela), 23.x.73, Tribe and Temby; 1 ♀, Hluhluwe G. R., (Seme), 24.xii.73, A. L. V. Davis; 1 ♀, Mkuzi G. R., (Vulture Pan), 22.xii.73, A. L. V. Davis; 1 ♂ and 1 ♀, Umfolozi G. R., 1-3.xi.76, G. Bernon; 15 ♂♂ and 8 ♀♀, Mkuzi G. R., 27-29.x.81, Edwards and Bridgens; 1 ♂ and 1 ♀, Mkuzi G. R., 23-26.iii.83, P. B. Edwards; 1 ♀, Mkuzi G. R., 23-25.v.83, P. B. Edwards. Holotype in the Naturhistoriska Riksmuseet, Stockholm.



Figs 1–11. *Kheper* spp. 1–3. *K. clericus* (Boheman); 1. pronotal disc, dorsal view; 2–3. aedeagus; 2. left paramere, lateral view; 3. ventral view. 4–5. *K. zurstrasseni* **sp. nov.**, aedeagus; 4. left paramere, lateral view; 5. ventral view. 6–8. Right forelegs of 3 *Kheper* spp., dorsal views showing diagnostic features of 3 species groups indicated by arrows; 6. *K. lamarcki* (MacLeay); 7. *K. nigroaeneus* (Boheman); 8. *K. cupreus* (Castelnau). 9–11. *K. bonellii* (MacLeay); 9. pronotal disc, dorsal view; 10–11. aedeagus; 10. left paramere, lateral view; 11. ventral view.

Kheper zurstrasseni* sp. nov.**, Figs 4, 5, 12Scarabaeus clericus*** (Boheman): Péringuey, 1902.***Kheper clericus*** (Boheman): Ferreira, 1972.

This species has been previously misidentified as *K. clericus* as discussed below.

MALE. Colour of body and hairs as for *K. clericus*. Length, 24–25 mm; mean, 24 mm ($n = 3$); maximum width, 14 mm.

Head. Similar to *K. clericus* in every respect.

Thorax. Prothoracic disc, metasternum and legs similar to *K. clericus*. Interstriae of elytra densely microgranular with dense, clearly elevated microrugosity ($\times 20$); when present, very sparse, fine punctation predominantly obscured by microrugosity.

Abdomen. Similar to *K. clericus* in every respect except aedeagus (Figs 4, 5).

FEMALE. Length, 22–23 mm; mean, 22 mm ($n = 4$). Only slightly different from male as in *K. clericus*.

The new species is named for Dr R. zur Strassen of the Forschungsinstitut und Naturmuseum, Senckenberg, Frankfurt am Main, West Germany, in recognition of his excellent work in scarabaeine taxonomy.

MATERIAL EXAMINED. Information in square brackets is not cited on the locality labels of the specimens. Holotype ♂: SOUTH AFRICA: Transvaal, Pretoria [25° 45' S, 28° 12' E], 21.ii.36, E. C. G. Bedford. Paratypes: 1 ♀, Pretoria, 21.ii.36, E. Bedford; 1 ♂, Transvaal, [?] J. Hume; 1 ♂ and 2 ♀♀, Potchefstroom [Dist[ri]ct] [26° 44' S, 27° 04' E]; 1 ♀, no data. Holotype and 4 paratypes in the National Collection of Insects, Pretoria; 2 paratypes in the South African Museum, Cape Town.

IDENTITY OF *KHEPER* MATERIAL EXAMINED. The new species belongs to a group of 3 close relatives which are endemic to South Africa. These species comprise, *K. bonellii* (MacLeay), *K. clericus* (Boheman) and *K. zurstrasseni* sp. nov. Material from the south west of Cape Province is undoubtedly *K. bonellii* but there is some confusion in published work between the identity of *K. clericus* and the new species.

Ateuchus clericus was described by Boheman (1857) and ultimately assigned to the genus *Kheper* (Janssens 1940a) via the genus *Scarabaeus* L. The holotype was collected by J. Wahlberg (etiquette reads, "J. WAHLB.") in "Caffraria". Material labelled in this way is considered to have been collected in Natal (R. Oberprieler, pers. comm.).

The holotype of *K. clericus* represents the same species as material in the reference collection of the DBRU which originates from the game reserves of northern Natal. Since *K. clericus* was formerly known from a single female specimen, I have used the holotype and the additional male and female material from the game reserves to redescribe the species.

Péringuey (1902) and Ferreira (1972) cited *clericus* from Potchefstroom, Pretoria and Zebediela in the Transvaal. I have attempted to trace this material in the National Collection of Insects and the Transvaal Museum in Pretoria and in the South African Museum in Cape Town. Although these institutions hold determined material of *clericus* from the above localities, none of the specimens can with certainty be recog-

nized as those cited by Péringuey and Ferreira. A single specimen from Potchefstroom in the National Collection determined as *K. clericus* by Ferreira in 1951 also bears a label reading, "Ateuchus clericus Boh. compared with type", possibly in Péringuey's handwriting. The labels on the remaining material of *clericus* from Potchefstroom and Pretoria which are lodged in the National Collection of Insects and the South African Museum, do not state the determining authority. All of this material has been misidentified and is, in fact, *K. zurstrasseni* sp. nov. A specimen from Zebediela (24° 18' S, 29° 19' E) determined as *K. clericus* by Ferreira in 1964 and lodged with the Transvaal Museum, is a melanic example of *K. nigroaeneus* (Boheman).

RELATIONSHIPS. The Afrotropical species of *Kheper* may be divided into 3 groups on the presence or absence of spines and denticles on the fore legs (Janssens 1940a) (Figs 6–8). The group typified by *K. lamarcki* (MacLeay), has a spine on the antero-inferior ridge of the fore femur, another on the internal superior ridge of the fore tibia and single denticles projecting from the dorsal surface of the fore tibia at the bases of tibial teeth 2 and 3 (Fig. 6). The group typified by *K. nigroaeneus* (Boheman), lacks spines on the femur and inner margin of the fore tibia and is characterized by a single denticle only at the base of tibial tooth 2 (Fig. 7). The third group, typified by *K. cupreus* (Castlenau), lacks all the spines and denticles described for the other 2 groups (Fig. 8).

K. zurstrasseni has a single denticle on the dorsal surface of the fore tibia at the base of tibial tooth 2 and, therefore, belongs to the *K. nigroaeneus* group. It has close affinities to *K. clericus* (Boheman) and *K. bonellii* (MacLeay). Descriptions of differences between these species and *K. zurstrasseni* are based on examinations of the holotype or syntype of each species. The external morphology of *K. clericus* differs from that of *K. zurstrasseni* only in having sparse but clear ($\times 20$), fine punctation over most of the elytra and, interstriae with incipient microrugosity which is not raised ($\times 20$). The aedeagi of the 2 species are, however, quite different (Figs 2, 3, 4, 5). *K. bonellii* differs from *K. zurstrasseni* in a number of features including the lack of macrogranulation or macropunctuation on the posterior 40% of the pronotal disc (Fig. 9), the sparsely microgranular pygidium, the discrete microgranules on the elytra, the acute, vestigial horn on the frons and the morphology of the aedeagus (Figs 10, 11).

The other species of the *K. nigroaeneus* group also differ clearly from *K. zurstrasseni* and may be separated using Janssens' key (1940a). These species are, *K. nigroaeneus* (Boheman), *K. pustulosus* (Gerstaecker), *K. aeratus* (Gerstaecker), *K. festivus* (Harold), *K. asceticus* (Gillet), *K. laevistriatus* (Fairemaire), *K. porosus* (Bates) and *K. intermedius* (Gillet).

Janssens (1940a) considers *K. paganus* (Harold) to be a synonym of *K. festivus*. I have examined specimens of *Kheper* collected in Angola (ex DBRU collection) which were identified as *K. paganus* by R. zur Strassen in 1975, and have compared them with material of *K. festivus*. I am in agreement with zur Strassen that *K. paganus* is a valid species. However, this decision needs to be confirmed by comparison of the holotypes.

DISTRIBUTION. There is no overlap between the geographical distributions of *K. bonellii*, *K. clericus* and *K. zurstrasseni* (based on material in the reference collections of the Dung Beetle Research Unit, the National Collection of Insects, Pretoria, and the South African Museum, Cape Town) (Fig. 12). *K. bonellii* is restricted to the winter rainfall region of South Africa (rainy season from April to October) where it has been

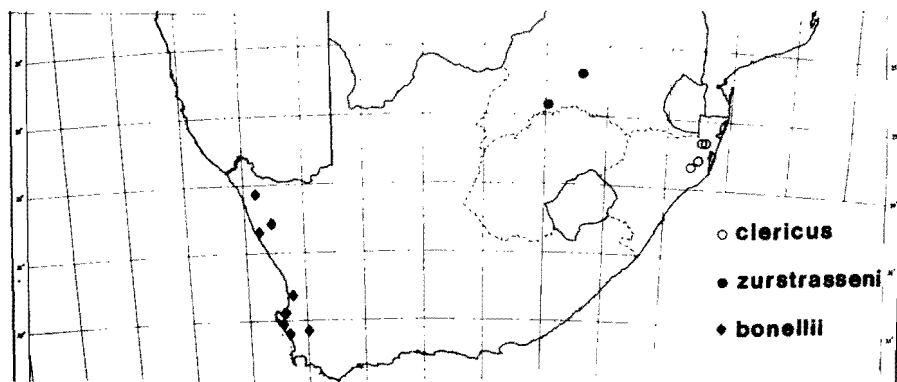


Fig. 12. Geographical distribution of *Kheper bonellii* (MacLeay), *K. clericus* (Boheman) and *K. zurstrasseni* sp. nov.

collected on sandy soils and deep sand. It is active predominantly during September and October although one specimen has been recorded during December. *K. clericus* has been found only in the Natal lowlands in the summer rainfall region of South Africa (rainy season from October to April) where it occurs on clay-loam (Makatini). It has been recorded during each month between September and May although peak abundance was observed in October and again in January (B. M. Doube, pers. comm.). *K. zurstrasseni* occurs on the Transvaal highveld in the summer rainfall region of South Africa.

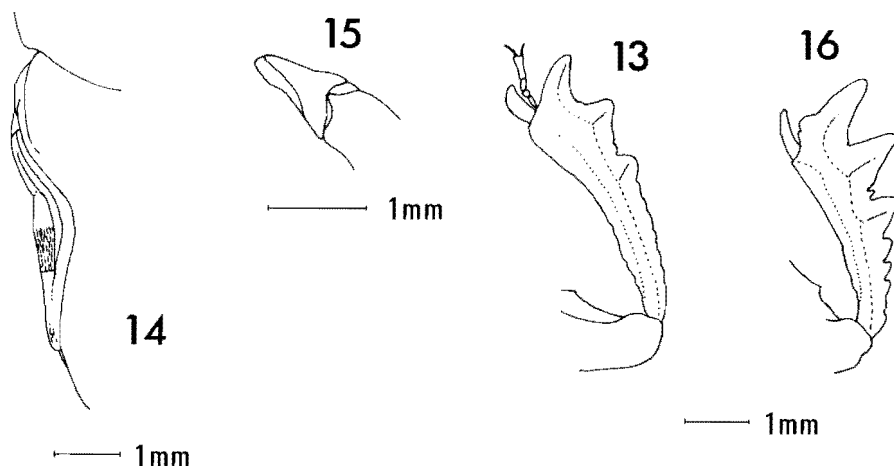
Genus *GYMNOPLEURUS* Illiger, 1803

The Palaearctic, Afrotropical and Oriental genus, *Gymnopleurus* s. str., was last revised by Janssens (1940b). In this publication, the diagnostic features of the genus were given and a key to all the known species was provided. In recent years, a further 4 valid species have been described, *G. andreaei* Ferreira, *G. imitator* Balthasar, *G. nyankpalensis* Endrödi and *G. rhodesianus* Balthasar.

Gymnopleurus particolor sp. nov., Figs 13–16

MALE. Pronotal disc and dorsal surface of head magenta with a pale green metallic sheen; elytra, legs and pectus green or deep blue with a blue or blue-green metallic sheen. Length, 4–10 mm; mean, 8 mm ($n = 10$); maximum width, 2–5 mm; mean, 4 mm.

Head. Lateral margins of strongly bidentate clypeus weakly sinuous, genal margin rounded. Clypeus with dense, submarginal, elongate, scalloped depressions and posteriorly-directed, peg-like setae ($\times 45$), posterior part of clypeus densely granular; genae granular; lateral granulation of vertex merging into umbilicate pits sublaterally. Mid-longitudinal line of head smooth, weakly raised and rounded except for short submarginal part of clypeus; smooth area becoming broad and weakly dome-like on the vertex. Clypeo-genal sutures distinct, moderately raised; frontal sutures raised laterally, effaced medially.



Figs 13–16. *Gymnopleurus particolor* sp. nov.; 13. ♀, emargination of left elytrum, epimeral ridge; 14. ♂, right fore tibia, dorsal view; 15. aedeagus, right paramere, lateral view; 16. ♀, right fore tibia, dorsal view.

Thorax. Pronotal disc strongly convex with sparse lunate and umbilicate punctation in an ill-defined pattern, distinctive features being, two small mid-sublateral patches of dense punctation, increasing density of pits towards antero-lateral angles merging into asperate granulation at the angles ($\times 30$), sparse punctation or raspy asperate granules laterally, ill-defined apunctate areas medially and sub-laterally and, an indistinct median groove between the anterior and basal margins often visible only posteriorly. Lateral impressions deep. Metasternum smooth medially, densely granular laterally ($\times 20$) with abundant white silky hairs; metasternal protuberance rounded, granular laterally. Elytra convex, lateral margins rounded in humeral region; interstria 1 without visible ($\times 0$) surface sculpture; interstria 2 with several large, only slightly raised, rounded humps in longitudinal series; interstriae 3–9 with ill-defined sparse lunate pits; interstriae 4–9 with dense, coarse, rugose microgranulation and micro-punctuation ($\times 45$). Anterior inferior ridge of fore femur with a very small, obtuse, medio-distal projection ($\times 20$); terminal spur of fore tibia bulbous (Fig. 13); median femur punctate and setose ventrally; hind femur densely punctate with abundant fine white hairs ventrally.

Abdomen. Epimeres 1 and 2, exposed by lateral emargination of the elytra, bearing 2 indistinct patches of fine white hairs ($\times 10$); epimeral ridge as in Fig. 14. Sternites densely microgranular with large, sparsely setiferous, asperate granules laterally ($\times 40$). Pygidium marginate and finely rugose ($\times 30$); aedeagus as in Fig. 15.

FEMALE. Length, 8–9 mm; mean, 8 mm ($n = 4$). Almost identical to male, differing only in the slightly shorter and broader fore tibia with an acute terminal spine (Fig. 16).

MATERIAL EXAMINED. Information in square brackets not cited on locality la-

bels of specimens. Holotype ♂: GHANA (cited as Gold Coast): 9 ♂♂ and 5 ♀♀ paratypes, Yapi [= New Tamale, 9° 10' N, 1° 02' W], x.1915, J. J. Simpson. NIGER: 1 ♂ paratype, Niamey [13° 31' N, 2° 20' E], 1977, D. Rougon. All specimens from Ghana in the British Museum (Natural History), London. Specimen from Niger in the Muséum National d'Histoire Naturelle, Paris.

RELATIONSHIPS. *G. particolor* sp. nov. has affinities with the species allied to *G. virens* Erichson. These species are characterized by a smooth, clearly apunctate and agranular mid-line of the head which is slightly raised and rounded from behind the bidentate clypeal margin to the basal ridge of the vertex. All of the species in the group are monochromatic except for the new species and *G. bicolor* Latreille which are bichromatic.

Descriptions of differences between *G. particolor* and other species are based on examinations of the holotypes of *G. virens* Erichson ssp. *sternalis* Müller, *G. sericeifrons* Fairemaire, *G. ignitus* Klug var. *nigrocupreus* Janssens and additional, reliably-identified material. *G. virens* differs from *G. particolor* only in its uniform colour, in the greater density of the punctuation medially on its pronotal disc and in the dense asperate granulation and rugosity laterally on the disc. Other close relatives are more clearly different. *G. sericeifrons* differs from *G. particolor* in having very fine, isodiametric punctuation medially on the pronotal disc and fine white hairs entirely covering the dorsal surface of the head. *G. ignitus* differs from *G. particolor* in having dense, coarse, u-shaped punctuation and smooth apunctate areas arranged in a distinct pattern on the pronotal disc.

The other species of the *G. virens* group also differ clearly from *G. particolor* and may be separated using Janssens' key (1940b). These species are, *G. fulgidus* Olivier, *G. bicolor* Latreille, *G. aenescens* Weidemann, *G. elegans* Klug, *G. forficarius* Garreta and the only known oriental member of the group, *G. koenigi* Fabricius.

Genus *ONITIS* Fabricius, 1798

The Afrotropical species of this Palaearctic, Afrotropical and Oriental genus were last revised by Ferreira (1978). In this publication, a key to the genera of the tribe Onitini was provided together with keys to the groups and species of the genus, *Onitis*, and redescriptions of each Afrotropical species.

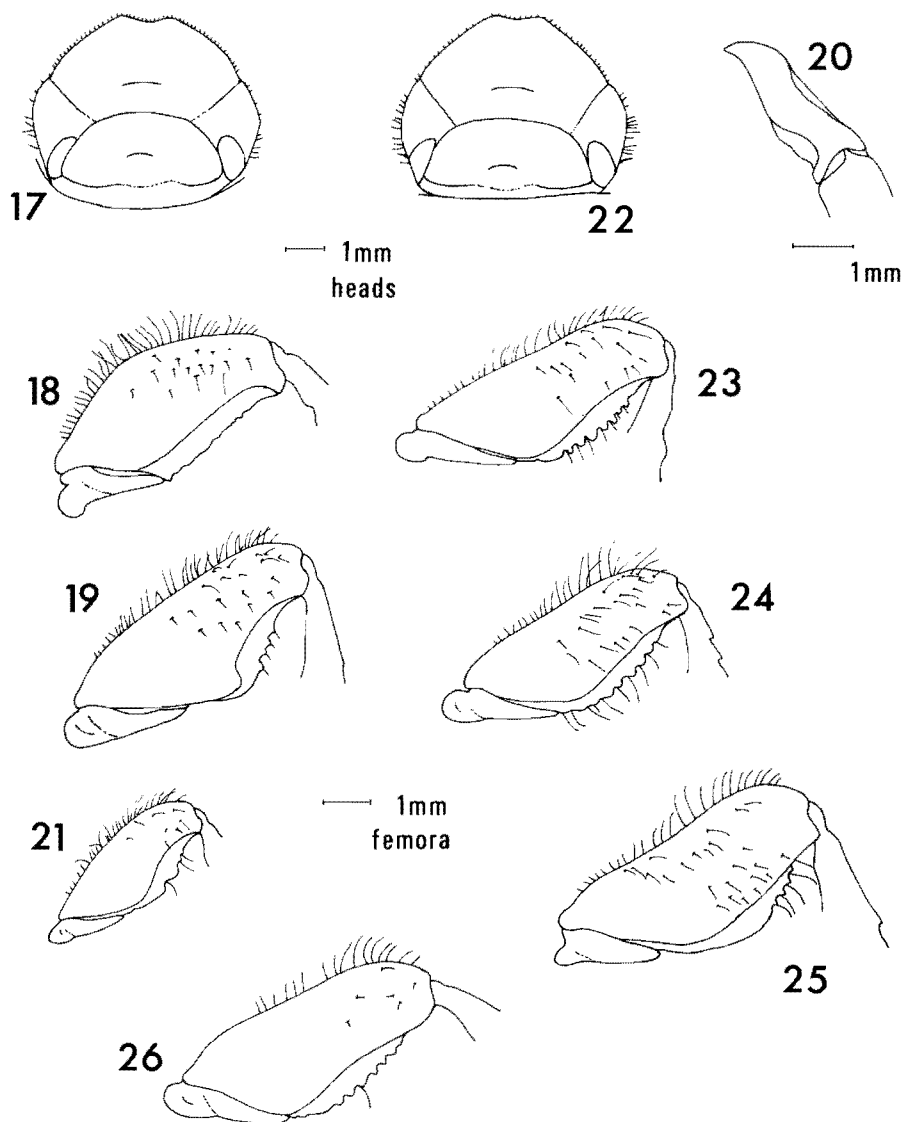
Onitis autumnalis sp. nov., Figs 17–21, 28

Onitis caffer Boheman: Ferreira, 1978, *ex parte* (misidentification of material from Zimbabwe).

MALE. Black with a strong sheen, very inconspicuously metallic; all pilosity tan. Length, 10–19 mm; mean, 16 mm ($n = 20$); maximum width, 5–10 mm; mean, 9 mm.

Head. Arcuate margin of clypeus very weakly bidentate anteriorly; clypeus with coarse isodiametric or weakly ovoid punctuation, becoming finer and more sparse posteriorly; genae sparsely and inconspicuously micropunctate; vertex with coarse but shallow punctuation ($\times 20$), basal margin forming a bisinuate ridge, somewhat effaced medially. Clypeo-genal and frontal sutures entire and strongly raised. Clypeal carina and tubercle of the vertex raised and prominent; tubercle of the vertex almost equidistant between frontal carina and basal margin of vertex (Fig. 17).

Thorax. Pronotal disc strongly convex with dense, coarse, squamose granulation mid-anteriorly extending to antero-lateral angles, becoming finer, more sparse



Figs 17–26. *Onitis* spp. 17–21. *O. autumnalis* **sp. nov.**; 17. ♂, head, dorsal view; 18. aedeagus, right paramere, lateral view; 19. ♂, right median femur, ventral view; 20. major ♂, right hind femur, ventral view; 21. minor ♂, right hind femur, ventral view. 22. *O. caffer* (Boheman), ♂, head, dorsal view. 23–26. major ♂, right hind femora, ventral views; 23. *O. caffer* Boheman; 24. *O. perpunctatus* Balthasar; 25. *O. confusus* Boheman; 26. *O. anthracinus* Felsche.

and asperate mid-posteriorly; towards post-lateral angles, granulation grading sequentially into gradually finer and more sparse lunate, umbilicate and then isodiametric punctation; disc densely microgranular between basal impressions; basal and lateral impressions deep. Metasternum abundantly punctate and pilose anteriorly with more sparse punctation and shorter hairs posteriorly, bearing a distinct, mid-sternal groove extending from near anterior margin almost to basal margin. Elytra convex, declivous laterally; striae incised and marginate, interstriae slightly convex and finely punctate with shallow, oblique, elongate depressions, density and coarseness variable between individuals. Fore tibia elongate, tip strongly recurved inwards in larger specimens; posterior superior ridge of median femur crenulate (Fig. 18); posterior margin of posterior femur produced into an obtuse, proximo-median lobe with distal crenulation of the posterior superior ridge, proximal portion of superior ridge entire (Fig. 19); each metacoxa with a large spur protruding under the trochanter.

Abdomen. Final sternite narrowing medially. Pygidium marginate with mid-transverse band of fine, pilose punctation; aedeagus as in Fig. 20.

Variation in males. As usual in *Onitis*, there is morphological variation and reduction in prominence of the secondary sexual characters of the males with the decreasing size of the specimens (Fig. 21).

FEMALE. Length, 13–18 mm; mean, 16 mm ($n = 20$). Clypeus with discrete, short, carinate granules anterior to clypeal carina; each metacoxa lacks spur under the trochanter. Otherwise the usual sexual dimorphism in *Onitis*. Fore tibia short and wedge-shaped, broad end distal; posterior superior ridges of median and hind legs only with minute, barely visible ($\times 10$) crenulation; final sternite without mid-sternal narrowing.

MATERIAL EXAMINED. In addition to my own labels, 18 of the 32 paratypes listed below also bear labels reading 'Onitis caffer Boh., M. C. Ferreira det., 19'. In the following list, information in square brackets is not cited on the locality labels of the specimens. Holotype ♂: ZIMBABWE (cited as Rhod[esia]): and 2 ♀♀ paratypes, Inyanga, 30 km W [$18^{\circ} 26' S$, $32^{\circ} 28' E$], 16.iv.73, H. H. Aschenborn. Other paratypes: 1 ♂, Salisbury [= Harare], 5 mi E [$17^{\circ} 52' S$, $31^{\circ} 09' E$], 8.iv.71, Bornemissza and Aschenborn; 7 ♂♂ and 7 ♀♀, Chipinga [= Chipinge], 12 mi N [$20^{\circ} 08' S$, $32^{\circ} 35' E$], 20.iv.71, Bornemissza and Aschenborn, 1 ♂, Silverstreams Riv[er] Bridge [$19^{\circ} 57' S$, $32^{\circ} 43' E$], Rhodesian highlands, 21.iv.71, Bornemissza and Aschenborn; 1 ♂, Chipinga, 10 mi N [$20^{\circ} 08' S$, $32^{\circ} 26' E$], 21.iv.71, Bornemissza and Aschenborn; 2 ♂♂ and 2 ♀♀, Umtali [= Mutare], 11 km S [$19^{\circ} 01' S$, $32^{\circ} 38' E$], 15.iv.73, H. H. Aschenborn; 1 ♀, Chipinga, 20 mi N [$19^{\circ} 57' S$, $32^{\circ} 43' E$], 20.iv.71, Bornemissza and Aschenborn; 2 ♂♂ and 6 ♀♀, Vumba Area, 11 mi SE Umtali [$19^{\circ} 06' S$, $32^{\circ} 41' E$], 5,200 ft [1600 m], 9.iv.71, Bornemissza and Aschenborn. Other material: 11 ♂♂ and 5 ♀♀, Umtali, 22 mi N [$18^{\circ} 40' S$, $32^{\circ} 43' E$], 9.iv.71, Bornemissza and Aschenborn; 21 ♂♂ and 11 ♀♀, Silverstreams Riv. Bridge, 3 mi N [$19^{\circ} 56' S$, $32^{\circ} 44' E$], 21.iv.71, Rhodesian highlands, Bornemissza and Aschenborn. Holotype in the National Collection of Insects, Pretoria; 20 paratypes in the collection of the Dung Beetle Research Unit, Pretoria and 4 paratypes in each of the following institutes, British Museum (Natural History), London; Australian National Insect Collection, Canberra and Muséum National d'Histoire Naturelle, Paris.

IDENTITY OF ONITIS MATERIAL EXAMINED. Of the 81 specimens of *O. autumnalis*

cited in this paper, 48 have been previously identified as *O. caffer* Boheman by M. C. Ferreira. As none of the identification labels is dated it is not possible to ascertain whether this material includes any of the 12 specimens from Zimbabwe (ex DBRU collection) identified as *O. caffer* by Ferreira (1978). However, it is probable that these misidentified specimens have been included in the type series of *O. autumnalis* since a large amount of material on loan to Ferreira was returned to the DBRU in July 1978 and, 22 specimens of *O. autumnalis*, cited in the present paper, were collected on the same dates and at the same localities as the 12 specimens.

Evidence that these 12 specimens were misidentified is provided by Ferreira's drawings and text (1978). Firstly, whereas Figure 254 is representative of the hind femur of male *O. caffer*, the hind femur depicted by Figure 261 is undoubtedly that of *O. autumnalis*. Secondly, Ferreira (1978) did note differences in the femoral morphology of males from the Zimbabwe material but suggested that these might represent the characters for major males of *O. caffer*. This is unlikely since similarly sized specimens of *O. caffer* from South Africa bear consistently different armament on the hind femora.

As all material from Zimbabwe which I have examined, is clearly *O. autumnalis*, this raises questions concerning the identity of material from Cafumpe, Moçambique ($19^{\circ} 06' S, 33^{\circ} 34' E$) (Fig. 27), cited as *O. caffer* Boheman by Gomes Alves (1950). Since I have not examined this material I am only able to point out that Cafumpe is close to the known geographical range of *O. autumnalis* but distant from that of *O. caffer* (Fig. 28).

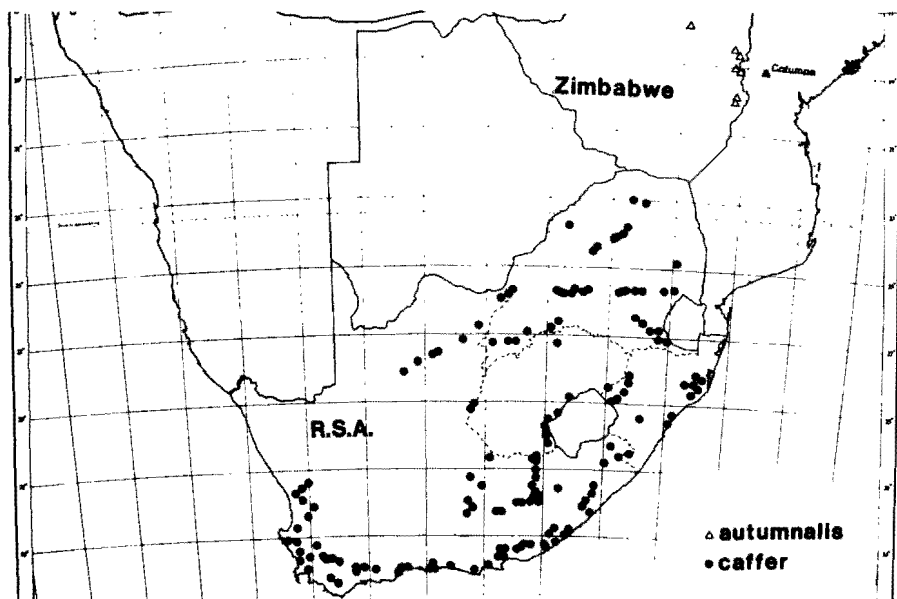


Fig. 27. Geographical distribution of *Onitis caffer* Boheman and *O. autumnalis* sp. nov. and the location of Cafumpe, Moçambique.

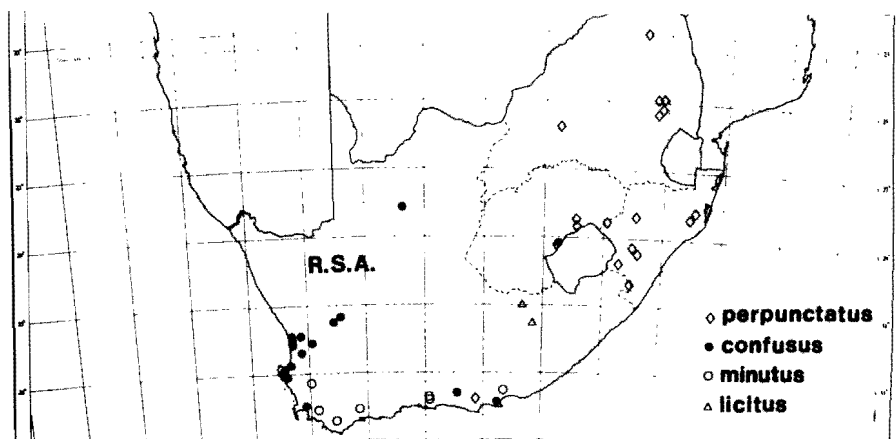


Fig. 28. Geographical distribution of 4 *Onitis* spp.; *O. perpunctatus* Balthasar, *O. confusus* Boheman, *O. licitus* Péringuey and *O. minutus* Lansberge.

RELATIONSHIPS. Janssens (1937) has separated the *Onitis* into a total of 20 groups subsequently reduced to 19 by Ferreira (1978). The new species belongs to Group VII. With the exception of females from Groups VIII and X, the species of Group VII differ from all Afrotropical members of the other groups by one or more of the following characters: clypeal carina present; frontal suture entire; tubercle present on vertex well anterior to basal margin and well posterior to carinate frontal suture; basal margin of vertex not strongly raised medially; with the exception of *O. perpunctatus* Balthasar, pronotal disc not entirely granular; metacoxa with spine under trochanter in males.

Descriptions of difference between *O. autumnalis* and closely-related species are based on material used for the redescription of each species by Ferreira (1978). *O. autumnalis* is closely allied to *O. caffer* and *O. perpunctatus*. In both sexes of *O. caffer* the vertex differs from that of the new species in being sparsely microgranular and in having a more posteriorly positioned tubercle (Fig. 22). The hind femur of males lacks a posterior lobular protrusion (Fig. 23) and the posterior superior ridge is almost entirely denticulate. Both sexes of *O. perpunctatus* differ from *O. autumnalis* in that the vertex, genae ($\times 30$) and the pronotal disc are entirely granular although umbilicate depressions between granules on the discs of some specimens may equally be interpreted as punctation. The morphology of the hind femur in males (Fig. 24) is similar to that of *O. caffer*.

Key to the Afrotropical species of *Onitis* belonging to Janssens' Group VII (males and females).

- 1 Pronotal disc almost entirely punctate or, granular anteriorly and entirely punctate posteriorly 2
- Pronotal disc entirely or partially granular, if partially granular, granulation always present mid-posteriorly 3
- 2 Pronotal disc granular at anterolateral angles and between basal impressions ($\times 20$); otherwise entirely punctate in both sexes; in males, posterior superior ridge of hind femur carinate terminating distally in 3–7 denticles (Fig. 25) *confusus* Boheman

- Pronotal disc granular at anterolateral angles, otherwise entirely punctate in male including between basal impressions ($\times 20$); in female, pronotal disc granular anteriorly and punctate posteriorly; in males, posterior superior ridge of hind femur entirely crenulate, denticles nine or more in number (Fig. 26) *anthracinus* Felsche
- 3 Entirely metallic green or metallic green with brown elytra and pygidium 4
- Entirely black 5
- 4 Entirely metallic green, sometimes with a rosy metallic sheen; in male, space between teeth 2 and 3 of fore tibia, 1.5 times greater than that between teeth 3 and 4 *licitus* Péringuey
- Elytra and pygidium brown, sometimes with a muted green metallic sheen, rest of body metallic green, sometimes with a cupreous metallic sheen; teeth of fore tibia equidistant *minutus* Lansberge
- 5 Genae granular ($\times 30$); pronotal disc entirely granular, sometimes with umbilicate depressions between granules; interstriae of elytra coarsely and densely punctate *perpunctatus* Balthasar
- Genae with shallow pits ($\times 30$); pronotal disc becoming distinctly punctate towards post-lateral angles; punctuation of elytral interstriae often fine but if coarse then also with shallow, elongate depressions 6
- 6 Vertex with shallow pits ($\times 30$); tubercle of vertex only slightly closer (approx. 0.2 times) to basal ridge of vertex than to frontal carina (Fig. 17); in male, crenulate posterior superior ridge of hind femur distal to lobular posterior extension of femoral margin (Fig. 20), denticles 4–6 in number *autumnalis* sp. nov.
- Vertex with sparse microgranulation ($\times 30$), somewhat rugose in female; tubercle of vertex approximately 2.0 times closer to basal ridge of vertex than to frontal carina (Fig. 22); in male, crenulate posterior superior ridge of hind femur not distal to a lobular posterior extension of femoral margin (Fig. 23), denticles 5–9 in number *caffer* Boheman

DISTRIBUTION. The geographical distribution of the new species and its six Afrotropical relatives in Group VII (according to material in the reference collection of the Dung Beetle Research Unit) is shown by Figures 27–29. The two tropical members of the group, *O. autumnalis* and *O. anthracinus*, both have highland distributions. Apart from *O. perpunctatus*, which has been collected predominantly between November and February, most reference material of Group VII has been collected during the cooler months of the year (March–October). The two species with the most southerly distribution, *O. licitus* (H. H. Aschenborn, pers. comm.) and *O. minutus* are both day-flying. All other Afrotropical *Onitis* with known flight periods are principally dusk-flying, including *O. caffer* and *O. confusus*. Other *Onitis* spp. with day-flying habits have only been recorded at the northern limits of the generic range, e.g. *O. numida* Castelnau in north Africa and *O. humerosus* (Pallas) in Iran (G. F. Bornemissza, pers. comm.).

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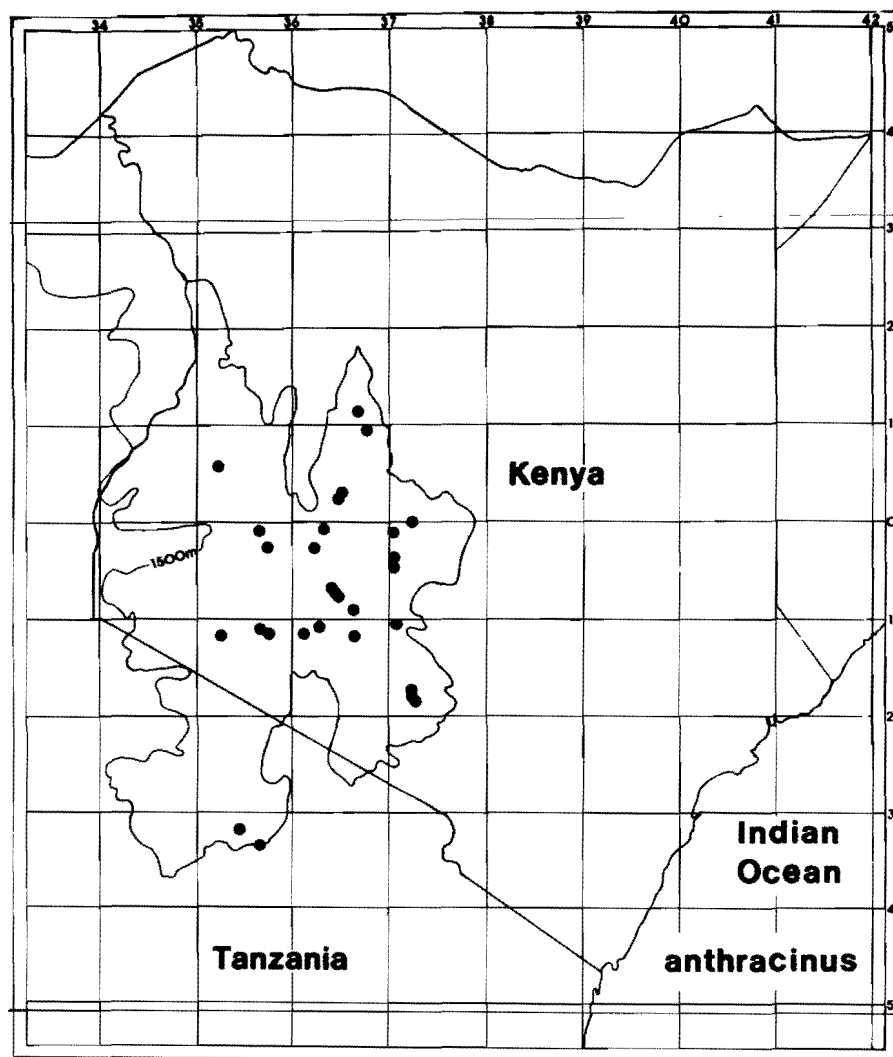


Fig. 29. Geographical distribution of *Onitis anthracinus* Felsche in relation to the 1500 m contour in Kenya and northern Tanzania.

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